CBER

CENTER FOR BIO-NANOTECHNOLOGY AND ENVIRONMENTAL RESEARCH

A NASA UNIVERSITY RESEARCH CENTER

Using a NASA University Research Center to Illustrate the Potential to Increase Minority Participation

Olufisayo Jejelowo, Ph. D.

NASA Ames Research Center, October 25 2009

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Education

Ph. D., 1987, University of Manchester, UK (Microbiology and Plant Pathology)

B. Sc. (Honors), 1982, University of Lagos, Lagos, Nigeria, (Major Botany)

Postdoctoral Fellowship, 1988-90, University of Alberta, Edmonton, Canada

Appointments

2008 - present, Director, NASA URC, Texas Southern University
2007 – present, Chair, Dept. of Biology, Texas Southern University
2006 – 2008, Chief Research Officer, NASA Science & Technology Institute
2002 – present, Professor of Biology, Texas Southern University
1996 – 2002, Associate Professor of Biology, Texas Southern University
1990 – 1995, Assistant Professor of Biology, Texas Southern University


HQ BULLETIN

National Aeronautics and Space Administration

NAFP: Helping NASA and Minority Institutions Shape the Future

Professional Honors

2002 – 2004, NAFEO Ames Research Academy Fellow, NASA Ames Center
2002 – 2003, NAFEO Ames Research Academy Fellow, NASA Ames Center
2002 - NASA Administrator's Fellow, NASA Ames Research Center
2001 - NASA Administrator's Fellow, NASA Johnson Space Center
2001 - NASA ASEE Summer Faculty Fellow, NASA Johnson Space Center
2000 – 2001, Visiting Scientist, NASA Johnson Space Center

Active Research Grants Award

NASA Group 4 University Research Center, CBER (2008-2013)
Texas Higher Education Coordinating Board, ARP (2008-2010)
NASA URETI TiiMS (2002-2009)
NASA Group 3 University Research Center, RCBEH (2003-2008)

Texas Southern University

Group 3 NASA URC: RCBEH

CBER CENTER FOR BIO-NANOTECHNOLOGY AND ENVIRONMENTAL RESEARCH

TSU

PURPOSE

Support Outcome one of the NASA Education Strategic Framework

Address Environmental and Human Health Concerns Related to Manned Exploration of Space

Develop technology that educate and drive the perception of what is possible in the realm of Space Life Sciences.

Develop a future workforce in STEM fields

Improve research infrastructure and innovative partnerships at TSU

Enhance technology transfers and commercialization

Improve quality of life on earth.

Organizational Chart

PRESIDENT
TEXAS SOUTHERN UNIVERSITY
Dr. John Rudley

PROVOST
TEXAS SOUTHERN UNIVERSITY
Dr. Sunny Ohia

DEAN
COLLEGE OF SCIENCE AND TECHNOLOGY
Dr. Lei Yu

NASA TECHNICAL REVIEW COMMITTEE

NATIONAL ADVISORY COMMITTEE

NASA URC CENTER DIRECTOR
Dr. Olufisayo Jejelowo

WORKFORCE, OUTREACH AND TECHNOLOGY TRANSFER

WORKFORCE
Dr. Claudette Ligons

K12 OUTREACH
Dr. Della Bell

INTELLECTUAL PROPERTY
Marguerite Butler

SPECIAL POPULATION OUTREACH
Dr. Pearlie Fennell

PUBLIC AFFAIRS
Dr. Olurominiyi Ibitayo

RESEARCH

RADIATION AND MICROGRAVITY
Dr. Mahmoud Saleh

SPACE MICROBIOLOGY
Dr. Olufisayo Jejelowo

BIO-NANOTECHNOLOGY BIOINFORMATICS AND BIOCHEMICAL SENSORS
Dr. Nancy Glenn

UNDERGRADUATE RESEARCH
Dr. Jason Rosenzweig

PROGRAM ADMINISTRATION

ADMINISTRATIVE PI
Dr. Shishir Shishodia

ADMINISTRATIVE ASSISTANT
Ms. Brandi Butler

PUBLICITY AND COMMUNICATIONS
Dr. Hector Miranda

FACILITIES COORDINATOR
Dr. Adoyotun Sodipe

CBER Technical Review Committee

Meyya Meyyappan, Ph. D. (Chair)
NASA CBER Technical Monitor
NASA Ames Research Center
Moffett Field, California 94035

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Higher Education Manager
Center Technical Officer
NASA Ames Research Center
Moffett Field, California 94035

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Moffett Field, California 94035

Honglu Wu, Ph. D.
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Houston Texas 77058

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NASA Dryden Flight Research Center
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California 93523

Katrina Emery
URC Project Manager
NASA Dryden Flight Research Center
4800 Lilly Drive, Edwards
California 93523

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CBER National Advisory Committee

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Email: danielhelen@msn.com

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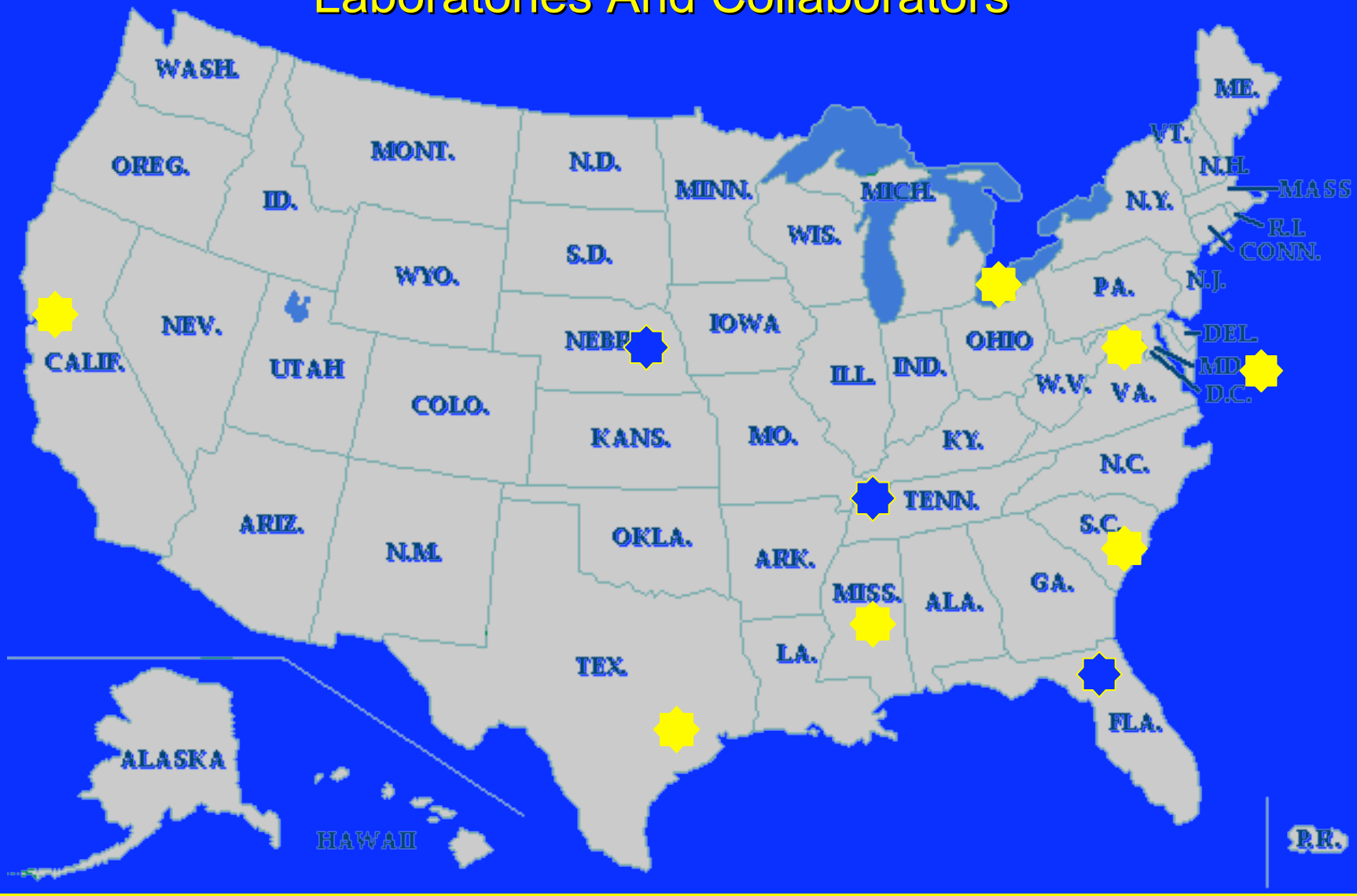
Email: chouston@utmb.edu

Casonya Johnson, Ph. D.
Associate Professor of Biology
Georgia State University, POB 3965
Atlanta, GA 30302
Phone: 404-413-5426
Email: cjohson113@gsu.edu

CBER Research Institutions

- Texas Southern University
- University of Houston
- University of California Santa Cruz
- Norfolk State University
- Texas A & M University
- Jackson State University
- Stanford University

Geographical Spread Of CBER Research Laboratories And Collaborators



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CBER Key Personnel

Olufisayo A Jejelowo, Ph. D.
Center Director
Professor and Chair
Department of Biology
Texas Southern University

Brandi Butler, B. S.
Program Coordinator and
Administrative Assistant
NASA URC
Texas Southern University

Fawzia Abdel-Rahman, Ph. D.
Co-Investigator
Professor
Department of Biology
Texas Southern University

Yvonne Hogan, Ph. D.
Co-Investigator
Professor
Department of Biology
Texas Southern University

Hector Miranda, Ph. D.
Co-Investigator
Assistant Professor
Department of Biology
Texas Southern University

Maribel Handy, MS
Program Staff
Department of Computer Sc
Texas Southern University

Jason Rosenzweig, Ph. D.
Co-Investigator
Assistant Professor
Department of Biology
Texas Southern University

Shishir Shishodia, Ph. D.
Co-Investigator
Assistant Professor
Department of Biology
Texas Southern University

Ayodotun Sodipe, Ph. D.
Co-Investigator
Assistant Professor (Visiting)
Department of Biology
Texas Southern University

Mahmoud Saleh, Ph. D.
Co-Investigator
Professor
Department of Chemistry
Texas Southern University

Pearlie Fennell, Ph. D.
Co-Investigator
Professor
Department of Chemistry
Texas Southern University

John Ford, Ph. D.
Collaborator
Associate Professor
Nuclear Engineering
Texas A & M University

Demetrios Kazakos, Ph. D.
Co-Investigator
Professor
Department of Mathematics
Texas Southern University

Nancy Glenn, Ph. D.
Co-Investigator
Associate Professor
Department of Mathematics
Texas Southern University

Claudette Ligons, Ed. D.
Co-Investigator
Professor
Department of Education
Texas Southern University

Marguerite Butler, J. D.
Co-Investigator
Associate Professor
College of Law
Texas Southern University

Oluro miniyi Ibitayo, Ph. D.
Co-Investigator
Associate Professor
Environmental Policy
Texas Southern University

Carlton Perkins, MBA
Co-Investigator
Professor
School of Business
Texas Southern University

James Briggs, Ph. D.
Collaborator
Associate Professor
Department of Chemistry
University of Houston

George Fox, Ph. D.
Collaborator
Professor
Department of Chemistry
University of Houston

Barbara Wilson, Ph. D.
Collaborator
Associate Professor
Department of Biology
Jackson State University

Govindarajan Ramesh, Ph. D.
Collaborator
Associate Professor
Department of Biology
Norfolk State University

Nader Pourmand, Ph. D.
Collaborator
Assistant Professor
Department of Bioengineering
UC Santa Cruz

Kamaleshwar Singh, Ph. D.
Collaborator
Assistant Professor
TIEHH-TTUHSC
Texas Tech University

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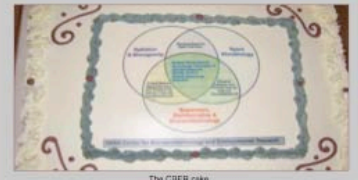
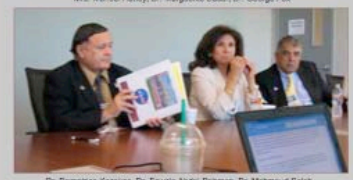
TSU NASA CBER Kick-off meeting


The CBER cake


CBER members with the cake


Mrs. Maribel Handy, Dr. Marguerite Butler, Dr. George Fox


Ms. Wendy Adair, Dr. Mahmoud Saleh, Prof. James Douglas


Dr. Demetrios Kazakos, Dr. Fawzia Abdel-Rahman, Dr. Mahmoud Saleh


Ms. Wendy Adair, Dr. James Briggs, Prof. James Douglas


CBER members with Dr. Sunny Ohia


Ms. Wendy Adair, Dr. Fawzia Abdel-Rahman, Prof. James Douglas


Prof. James Douglas, Dr. Demetrios Kazakos, Ms. Wendy Adair, Dr. Fawzia Abdel-Rahman


Ms. Wendy Adair, Dr. Yvonne Hogan, Prof. James Douglas

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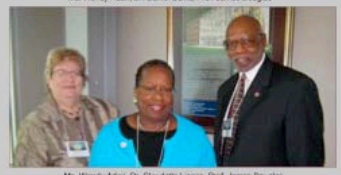
TSU NASA CBER Kick-off meeting


Ms. Wendy Adair, Dr. Govindrajan Ramesh, Prof. James Douglas


Ms. Wendy Adair, Dr. Hector Miranda, Prof. James Douglas


Ms. Wendy Adair, Dr. Daniel Davis, Prof. James Douglas


Ms. Wendy Adair, Dr. Jason Rosenzweig, Prof. James Douglas


Ms. Wendy Adair, Dr. Claudette Ligons, Prof. James Douglas


Ms. Wendy Adair, Dr. Marguerite Butler, Prof. James Douglas


Ms. Wendy Adair, Dr. Pearlie Fennell, Prof. James Douglas


Ms. Wendy Adair, Dr. Nancy Glenn, Prof. James Douglas


Ms. Wendy Adair, Dr. Demetrios Kazakos, Prof. James Douglas


Ms. Wendy Adair, Dr. Oluromiyi Ibitayo, Prof. James Douglas

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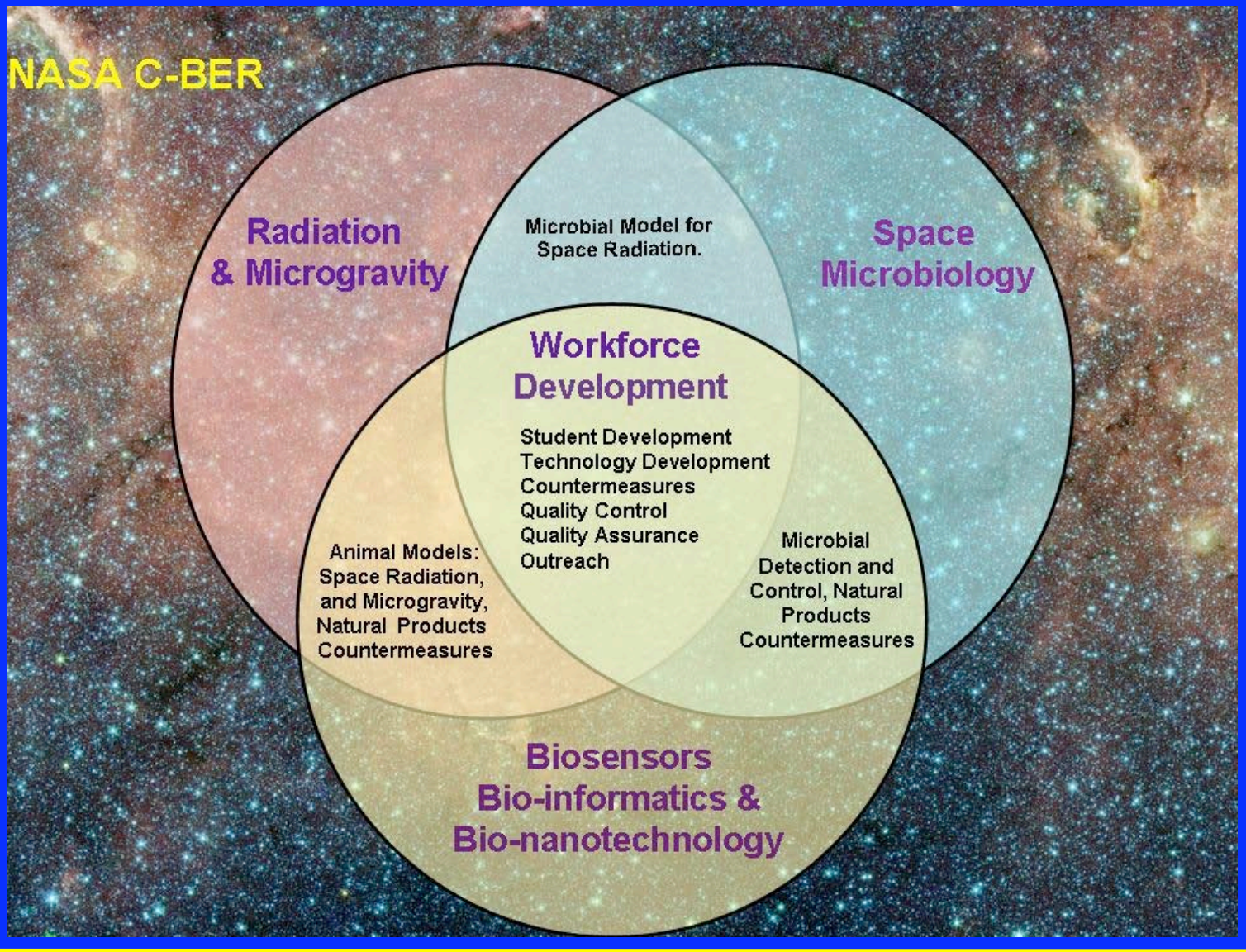
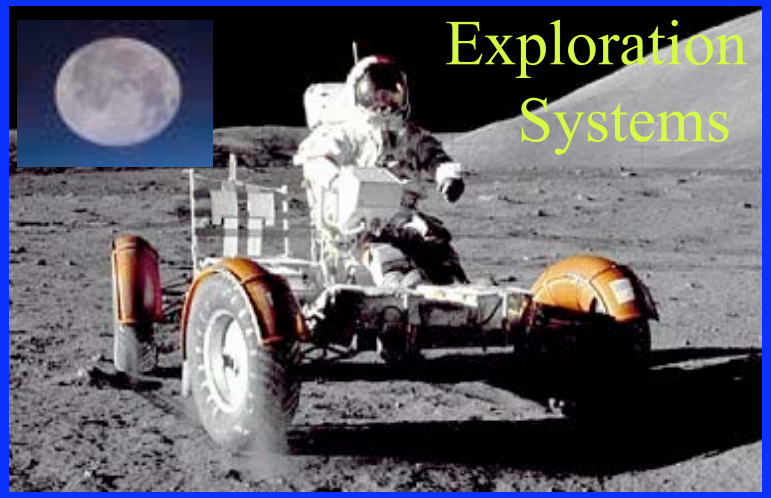
Diverse Multidisciplinary Team

Number of Females	11
Number of Males	15
Number of African Americans	15
Number of Asians	4
Number of Caucasians	5
Number of Hispanics	1
Number of Native Americans	1

CBER Technical Areas Of Research



Relevance of Research to NASA



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CHALLENGE

How can NASA Increase Recruitment from Minority Serving Institutions?

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Some evidence of the problem is presented in three areas

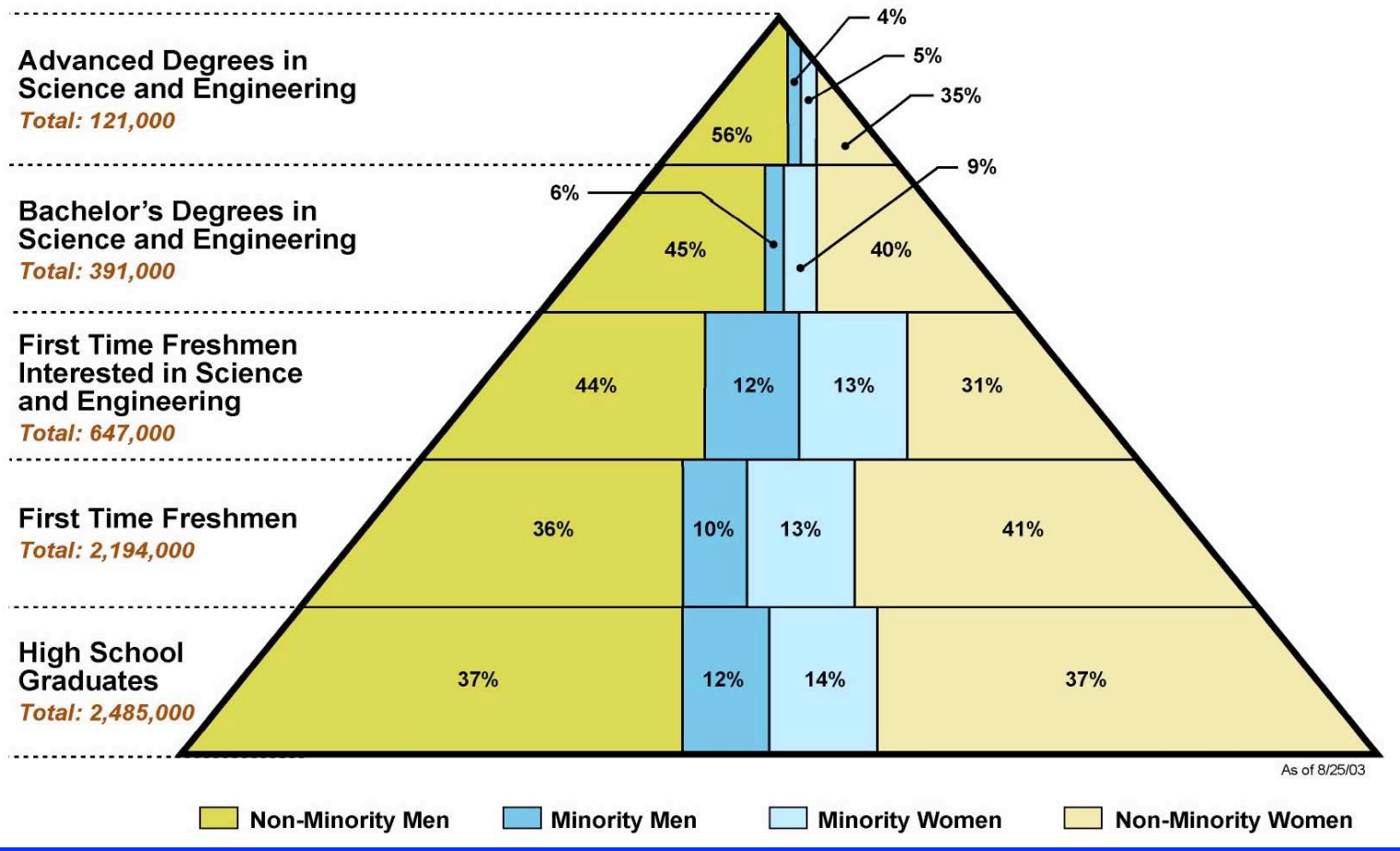
Trends in STEM student enrollment, retention and graduation

Clarity of NASA's aims, missions and goals relative to underrepresented minorities..

Opportunities such as Networking, Access, Choice and Ultimate employment

Education Milestones by Race/Ethnicity and Gender

(Rounded numbers)



Minority = Black/African American, Hispanic, and American Indian

Source: *Joan Burrelli, NSF, based on 1999 Common Core of Data, U.S. Department of Education, National Center for Education Statistics (NCES); NCES, 1998 IPEDS Fall Enrollment Survey; UCLA Higher Education Research Institute,1998 American Freshman Survey (estimate); and NCES, 1998 IPEDS Completions Survey*

Evidence of Under-representation in the S&E Workforce

Sex, Race/Ethnicity and Disabilities	Percentage U.S. Population 1999	Percentage Total Workforce 1999	Percentage S&E Workforce 1999
White men	35.2	39.9	63.2
White women	36.7	34.8	18.6
Asian men	1.8	2.0	8.4
Asian women	2	1.8	2.6
Black men	5.7	4.9	2.1
Black women	6.4	5.9	1.3
Hispanic men	5.8	5.9	2.4
Hispanic women	5.7	4.2	1.0
American Indian men	0.4	N.A.	0.2
American Indian women	0.4	N.A.	0.1
Persons with Disabilities	~20	N.A.	N.A.

Source: CPST, data derived from National Science Foundation, SESTAT and U.S. Census Bureau, Current Population Survey, March 1999, and NSB, 2002.Note: Totals may not add to 100 due to rounding.

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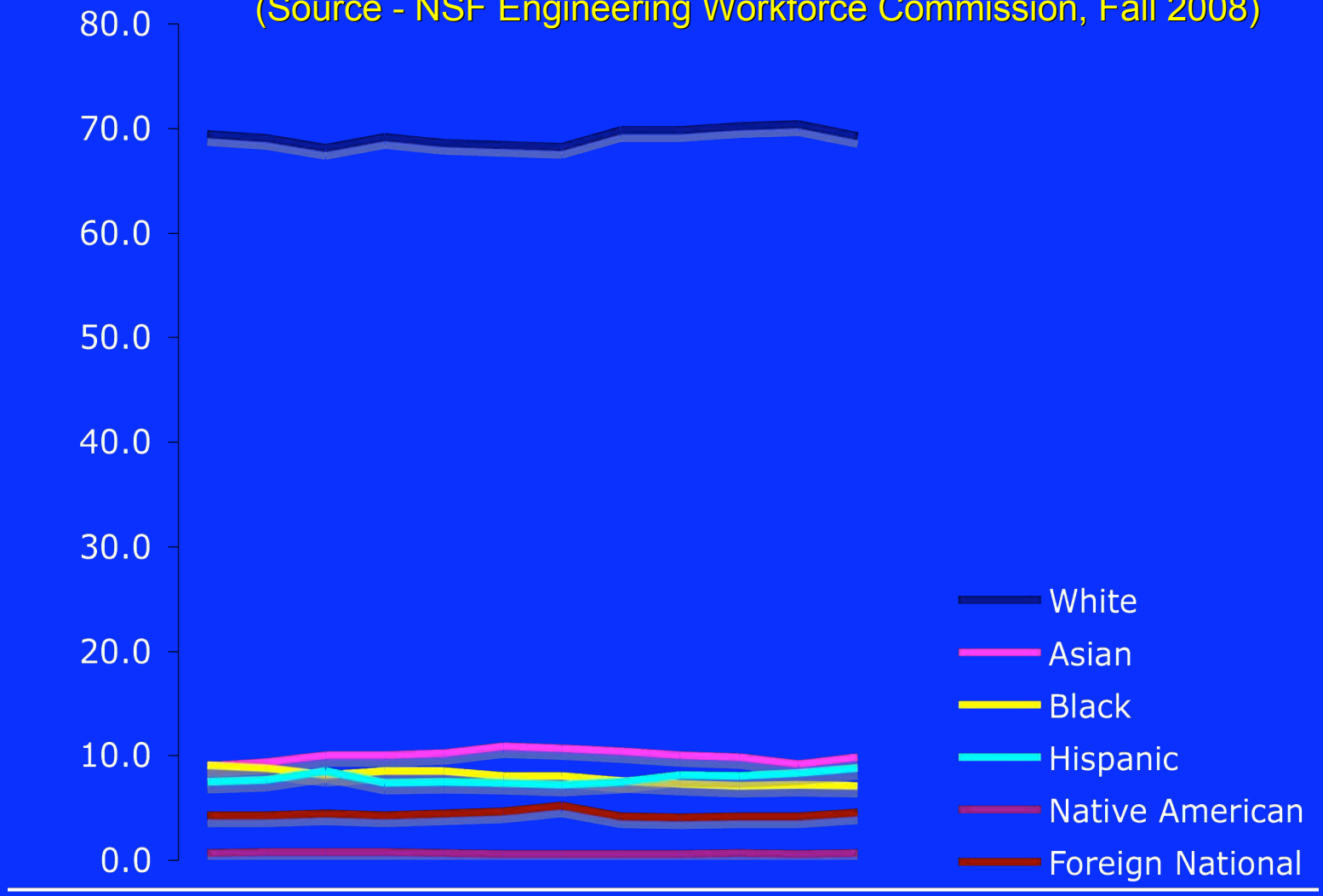
First Time Undergraduate Students by Race

(Source - NSF Engineering Workforce Commission, Fall 2008)



1995 through 2005

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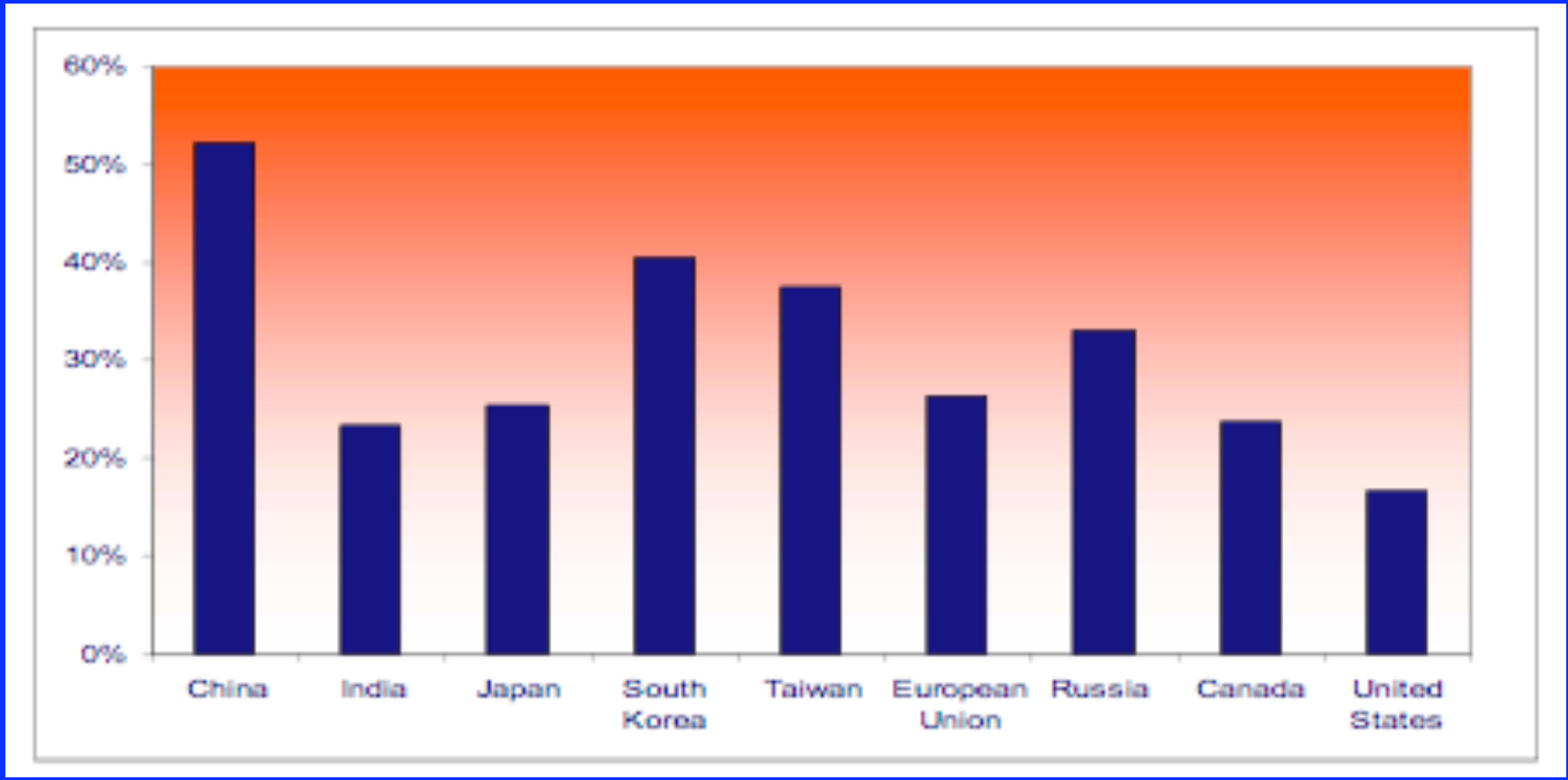
Percentage of First Degree University Students Receiving Degrees in SE



Workforce Development Thrust (WDT)

Specific Objectives

1. Student recruitment and retention
2. TSU Faculty and Student Development Plan
3. Undergraduate Summer Internship Program
4. Outreach Programs

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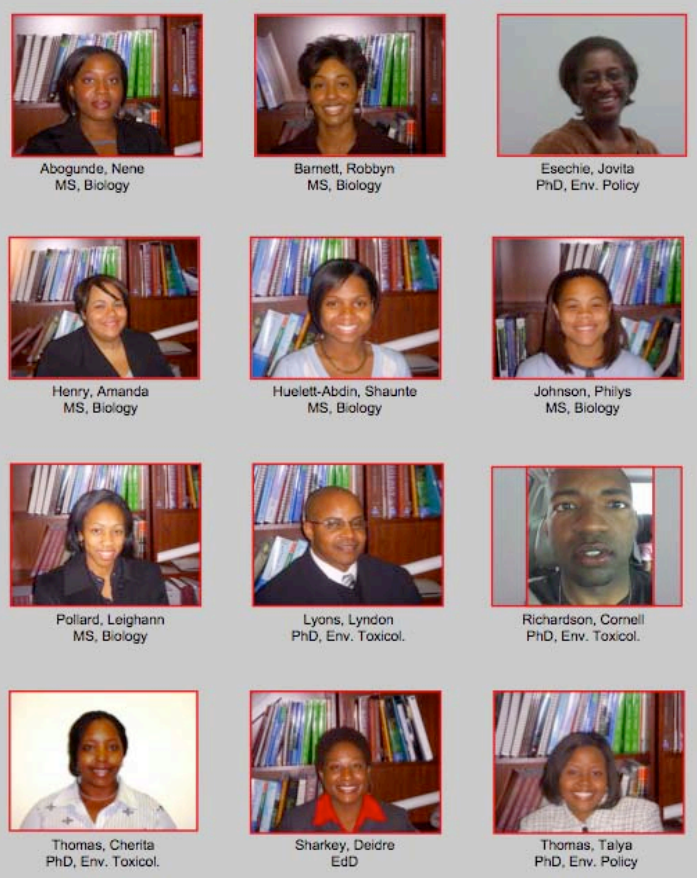
WDT Objectives 1.1 Financial Support and 1.3 Mentored Research CBER Scholars (Undergraduates) and Fellows (Graduate) Program

NASA CBER SCHOLARS AND FELLOWS - Cohort 1				
Name	**College**	**Gender/Race**	**Future Path**	**Mentor**
NASA CBER Fellows				
Abogunde, Nene	COST	F/African-American	MS, Biology	Rosenzweig
Barnett, Robbyn	COST	F/African-American	MS, Biology	Jejelowo
Esechie, Jovita	Pub Affairs	F/African-American	PhD, Env. Policy	Ibitayo
Henry, Amanda	COST	F/African-American	MS, Biology	Shishodia
Huelett_Abdin,Shaunte	COST	F/African-American	MS, Biology	Rosenzweig
Johnson, Phylis	COST	F/African-American	MS, Biology	Shishodia
Lyons, Lyndon	COST	M/African-American	PhD, Env. Tox	Jejelowo
Pollard, Leighann	COST	F/African-American	MS, Biology	Miranda
Richardson, Cornell	COST	M/African-American	PhD, Env. Tox	Saleh
Sharkey, Deidre	Education	F/African-American	EdD	Ligons
Thomas, Cherita	COST	F/African-American	PhD, Env. Tox	Jejelowo
Thomas, Talya	Pub Affairs	F/African-American	PhD, Env. Policy	Ibitayo
NASA CBER Scholars				
Agina, Pamela	COST	F/African-American	BS, Biology	Jejelowo
Berry, Kursten	COST	F/African-American	BS, Biology	Abdel-Rahman
Enogene, Augustine	COST	M/African-American	BS, Math/Engg.	Glenn
Garcia, Jerry	COST	M/Hispanic	BS, Airway Science	Jejelowo/Glass
Lane, Malika	COST	F/African-American	BS, Biology	Jejelowo
Miller, Kimberly	COST	F/African-American	BS, Biology	Abdel-Rahman
Nguyen, Uyen	COST	F/Asian	BS, Biology	Rosenzweig
Osiyami, Tope	COST	F/African-American	BS, Chemistry	Rosenzweig
Parks, Kelsey	COST	F/African-American	BS, Biology	Rosenzweig
Washington, Justin	COST	M/African-American	BS, Biology	Shishodia
Whitherspoon, Marvin	COST	M/African-American	BS, Airway Science	Jejelowo/Glass
Wilson, Brandi	COST	F/African-American	BS, Biology	Rosenzweig

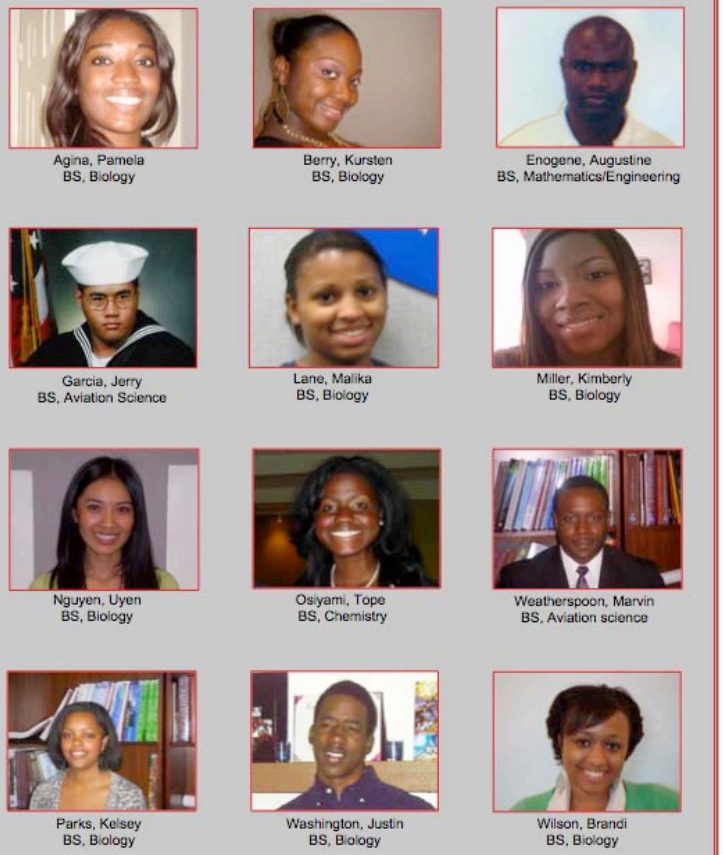
Students were selected after a a competitive process and receive direct financial support from NASA URC CBER funds

WDT Objective 1.1. CBER Scholars and Fellows

NASA CBER Fellows Cohort 1



NASA CBER Scholars Cohort 1



WDT Objective 1.2 Curriculum Improvement

COURSE/FACILITY	ACTION	RESPONSIBLE PERSON(S)
Cell Biology (undergraduate course)	Facilities improvement, Curriculum Revision, Implementation and Assessment	Shishodia, Thomas
Microbiology (undergraduate course)	Facilities improvement, Curriculum Revision, Implementation and Assessment	Rosenzweig, Sodipe, Lawal
Histology (undergraduate /graduate course)	Facilities improvement, Curriculum Revision, Implementation and Assessment	Shishodia
Experimental Biology 1 (graduate course)	Facilities improvement, Curriculum Revision, Implementation and Assessment	Shishodia
Systematics/Bioinformatics (undergraduate course)	Facilities improvement, Curriculum Revision, Implementation and Assessment	Miranda
Biology Courses	Applied AGILE Mind Research Based Resources to Biology teaching	Kazakos, Miranda, Shishodia
Biology Courses	We have incorporated latest advances and cutting edge technics into all areas of our student training and development.	Rosenzweig, Sodipe, Shishodia, Miranda
Biochemical Ecology	Facilities improvement, Curriculum Revision, Implementation and Assessment	Shishodia

WDT Objective 1.4. Early Exposure to STEM Fields

Activity and Responsible CBER Personnel	Participants
Summer Internship (Brandi Butler)	10 (JSC 5, TSU, 5)
College for a Day - High School Students (Shishodia, Miranda, Sodipe)	200
McNair Scholars Summer Research for students from Texas College, Wiley College (Shishodia)	3
Support for DREME Foundation Summer Science CAMP for Middle School Students and Teachers (Miranda, Sodipe, Shishodia, Butler, B, Pittman, Jejelowo , CBER Scholars and Fellows)	9 Companies Over 200 students

DREME Click to see video

Summer Internship Experience at NASA JSC

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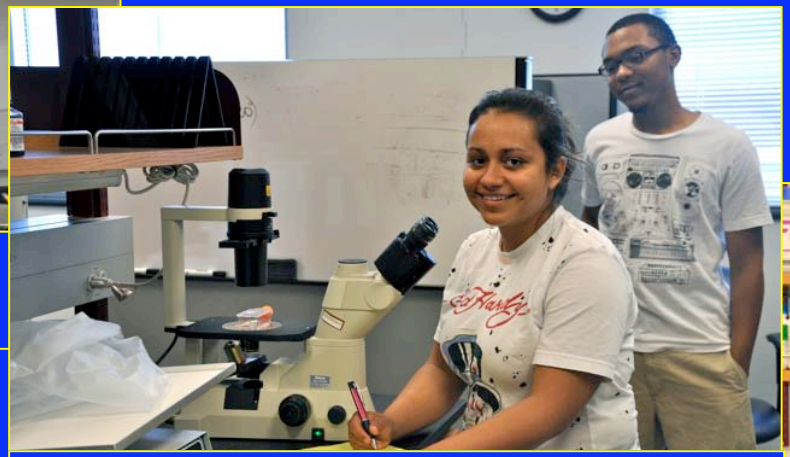
Three scholars in the Acclaimed Dr. Ronald E. McNair Scholars Program Engaged in Summer Research at TSU -2009

Xavier Lebron
B.S. Biology, Wiley College



Jennifer Garcia, B.S. Biology, Texas College

Voshawn Johnson,
B.S. Biology, Texas. College

Advisor - Dr. Shishodia
McNair Program Director-Dr. Neally

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WDT Objective 1.5. Seminars, Workshops and Symposium

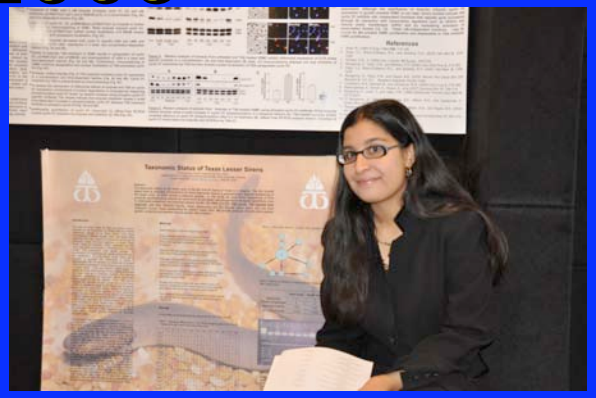
Activity	Number Sponsored by CBER
Student Orientation workshop	1
Student Training Workshops	4
Radiation Workshop	1
Symposium	1
Research Week	1
CBER Seminar Series	13

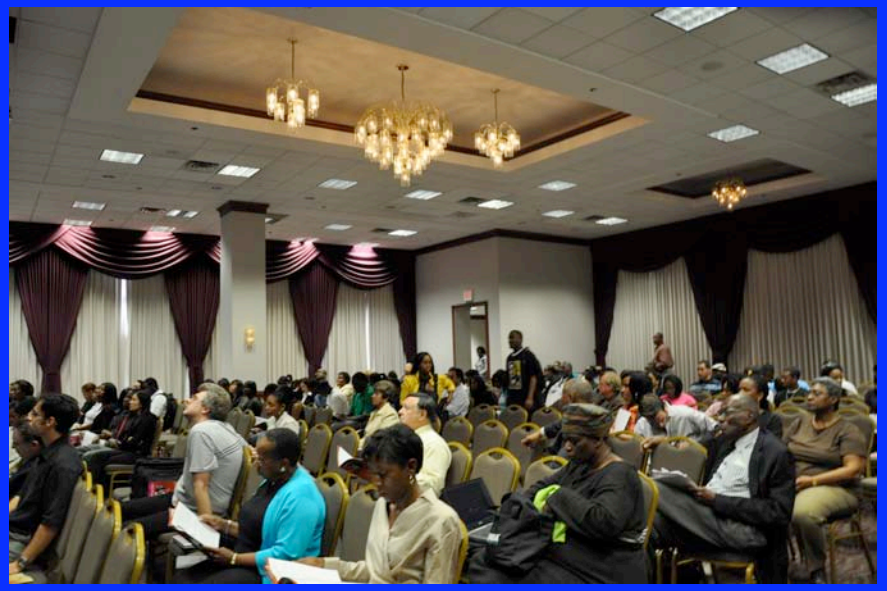
FIRST CBER ANNUAL SYMPOSIUM
TAS JUNCTION TEXAS MARCH 2009

CBER CENTER FOR BIO-NANOTECHNOLOGY AND ENVIRONMENTAL RESEARCH

TSU

TSU Research Week
March 30, April 6, 2009





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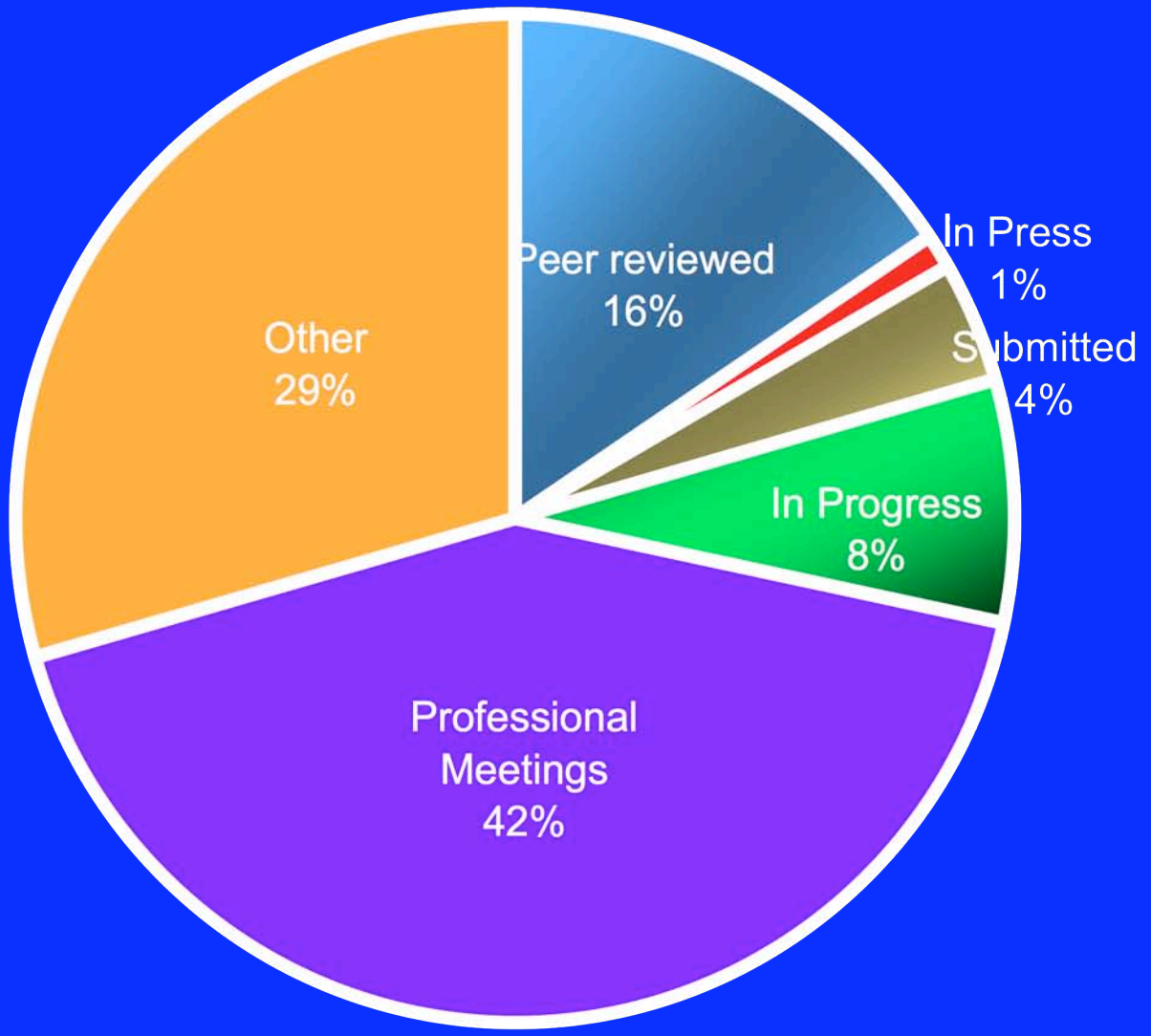
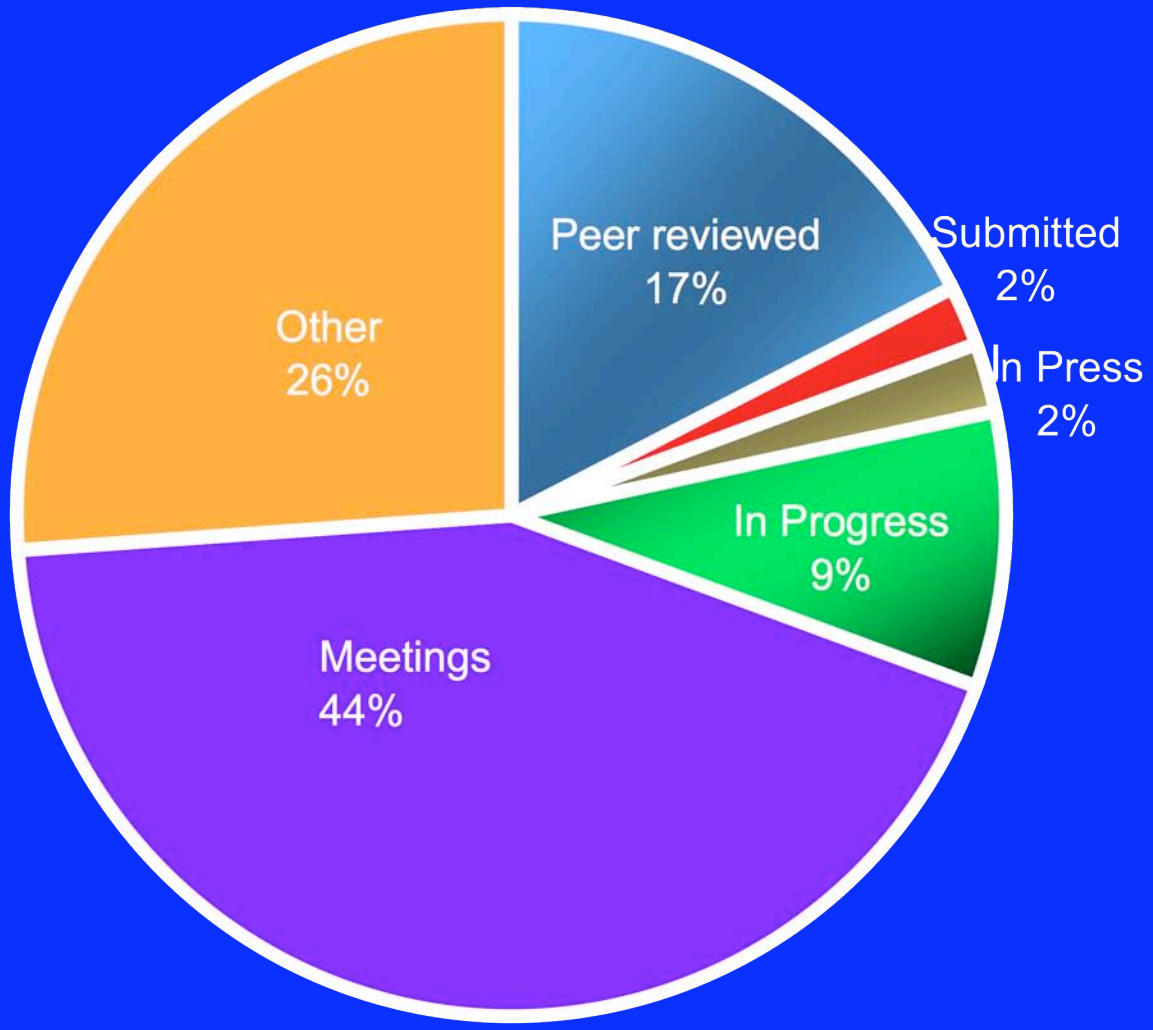
First Year Anniversary Keynote Speaker Dr. Jeff Davis, Director of NASA Space Life Sciences

CBER Publications and Presentations (102)



Student Publications and Presentations (46)



Seminar Series Participation

SPEAKER	STUDENTS	ALL
Dr. Honglu Wu	100	120
Dr. Nader Pourmand	70	85
Dr. Jacob Cohen	180	240
Dr. Ashok Chopra	52	65
Dr. Akif Uzman	17	25
Dr. Criner	24	34
Georgette Rolle	20	30
Leighann Pollard	18	26
Stephen Hayes	19	28
Philys Johnson	17	29
Dr. Shishodia	16	20
Dr. Tymczack	35	47
Nellen Nwaobasi	13	20
Total # of Participants	581	769

Proposals Submitted

Agency	Title	Submission Id #	Amount ($)	Outcome
DOD-CDMRP BCRP 2008	Preclinical Evaluation of Guggulsterone for Suppression of Breast Cancer ((PI : Shishodia))	BC076421	110,237	Not Funded
NASA NRA NNH08ZTT003N	Role of NF-kB Signaling in Microgravity Associated Muscular Atrophy (PI : Shishodia)	08-FSB-Prop-0066	252,106	Not Funded
DOD-CDMRP BCRP CA 2009	Guggulsterone as a Novel Chemopreventive Agent Against Breast Cancer (PI : Shishodia)	BC087299	109,252	Not Funded
TSU Seed Grant 2009	Role of TNF Signaling in Proliferation, Invasion, and Metastasis of Melanoma (PI : Shishodia)	NA	15,000	Funded
TSU Seed Grant 2009	A Study in Avian Molecular Systematics and Evolution Based on Mitochondrial and Nuclear Genes (PI: Miranda)	NA	15,000	Funded
TSU Seed Grant 2009	Evaluation of Cold Growth and Host Cell Induced Bacterial Stress Responses (PI: Rosenzweig)	NA	15,000	Funded
NSF	Center for Research on Resilient Infrastructure Networks (CR2IN) at Texas Southern University. PI: Kazakos	NA	5M	Not Funded
NIH/NCRR-RCMI	Biomarker Toxicology Core Facility (PI: Saleh)	NA	1.5M	Not Funded
NSF - MRI	Acquisition of GC/Triple Quadrupole Mass Spectrometer with Simultaneous Isotope RMDetector (PI: Saleh)	NA	1.39M	Not Funded
DOD-CDMRP PCRP 2008	TSU-UTGSBS Undergraduate Collaborative Training Program in Prostate Cancer (TSU PD: Shishodia)	PC080017	173,217	Funded
DOD-CDMRP LCRP CA 2009	Prevention and Therapy of Lung Cancer with Guggulsterone (PI:Shishodia)	LC090483	109,252	Pending
THECB-NHARP 2009	Mechanism Of Cigarette Smoke Induced NF-kappaB Activation (PI: Shishodia)	03642-0013-2009	200,000	Pending
NIH R15 AREA 2009	A Study Evaluating The Effect Of Guggulsterone And Taxol Combination On Breast Cancer (PI: Shishodia)	GRANT10425855	421,673	Pending

Relevance of CBER to TSU's Interim Strategic Plan

Goal 1	*PROVIDE HIGH-QUALITY INSTRUCTION*
Goal 2	*PROVIDE BASIC AND APPLIED RESEARCH*
Goal 3	*PROVIDE PUBLIC SERVICE*
Goal 4	*OPTIMIZE ENROLLMENT OF QUALIFIED STUDENTS TO SUSTAIN TEXAS SOUTHERN AS A HIGH QUALITY UNIERSITY*
Goal 5	*ENSURE STEADY AND SIGNIFICANT INCREASE IN PHILANTRHROPY, ALUMNI GIFTS AND PARTICIPATION, AS WELL AS PRIVATE SECTOR DONATIONS*
Goal 6	*ENSURE THAT EACH ADMINISTRATIVE UNIT EFFECTIVELY AND EFFICIENTLY SUPPORTS THE UNIVERSITY'S MISSION*

Radiation and Microgravity Thrust (RMT)

Specific Objectives

1. To investigate the simultaneous effect of radiation and microgravity using model cells and organisms

2. To develop countermeasures for the effects of radiation and microgravity

RMT Objective. 1.1. Microgravity Experiments

Purchased 4 HARV Reactors (High aspect Rotating Vessels) to simulate microgravity.

Microgravity Experiments using Bacteria, Nematodes and Cells lines are ongoing

OUTCOME:

1 Paper Published
1 Paper Accepted
1 Paper Under Development

RMT Objective 1.3. Radiation Exposure Experiments

Obtained protocol approvals at the Brookhaven National Laboratories and the Loma Linda University Radiation facilities

Group conducted radiation exposure experiments twice at the Loma Linda and one Co-I conducted experiments at the Brookhaven National Laboratories.

Balb C mice were exposed to 0 (control) and 1 gev protons rays (0.01gy, 1gy, 2gy), that cover a wide range of the LETt value. Animal tissues were harvested and shipped to various CBER research laboratories nationwide for experimentation.

OUTCOME:
1 Paper Submitted
3 Papers Under Development

Space Microbiology Thrust (SMT)

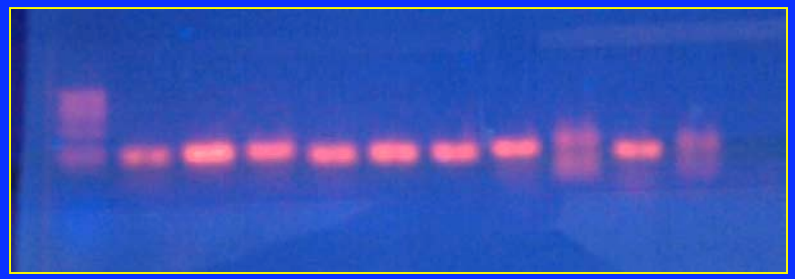
Specific Objectives

1. Understand the effect of space on microbial evolution using genomic techniques.

2. Understand the effects of space on microbial ecology, growth kinetics, morphology and virulence

3. Develop novel methods for identifying and controlling microorganisms in confined environments

SMT Objective 1
Students Are Trained To Extract And Amplify DNA From Regions Of Interest



Preliminary result of PCR amplification of ITS 1 and ITS 2 using different primer pairs. Genomic isolation of *Aspergillus* sp. were done using the MO BIO microbial isolation Kit.

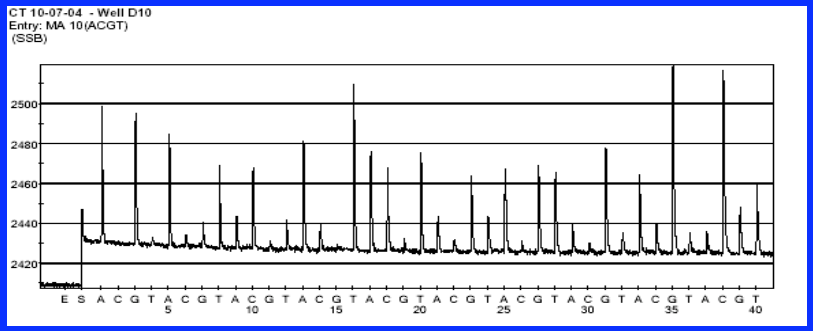
Labeled ID: *Fusarium heterosporum*

Primer Sequence:

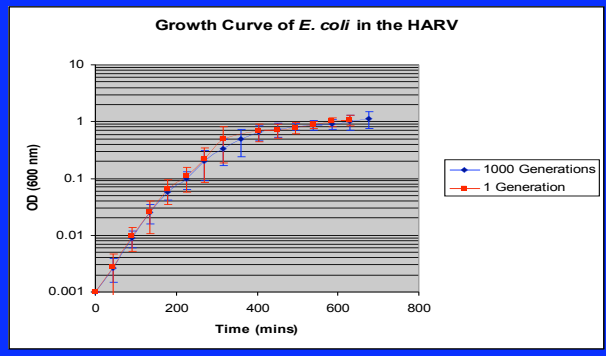
AGGCATCATTACCGAGTTTACAACT (ITS1 region)

Expected Sequence:

AGGCATCATTACCGAGTTTACAACT



SMT Objective 2
Growth Kinetics Under Microgravity



Results: Growth kinetics-minimal difference Seen in this case.

General and Specific Primers were designed for amplification of Regions of Interest followed by sequencing as in the Pyrogram shown on the left.

Environmental Samples were onbtained and undergoing analysis

OUTCOME

1 Paper Accepted For Publication
2 Papers Under Development

Bio-nanotechnology, Bioinformatics and Biosensors Thrust (BBB)

Specific Objectives

1. Develop a microarray-based platform to identify microbes in space

2. To develop a DNA hybridization-based portable microbial detector

3. To develop a multiplexed nanopipette system that detects proteins for microbial identification

4. To employ bioinformatics and statistical techniques to test and verify proposed methods and results

Technology Developed for Microbe and Toxin Detection

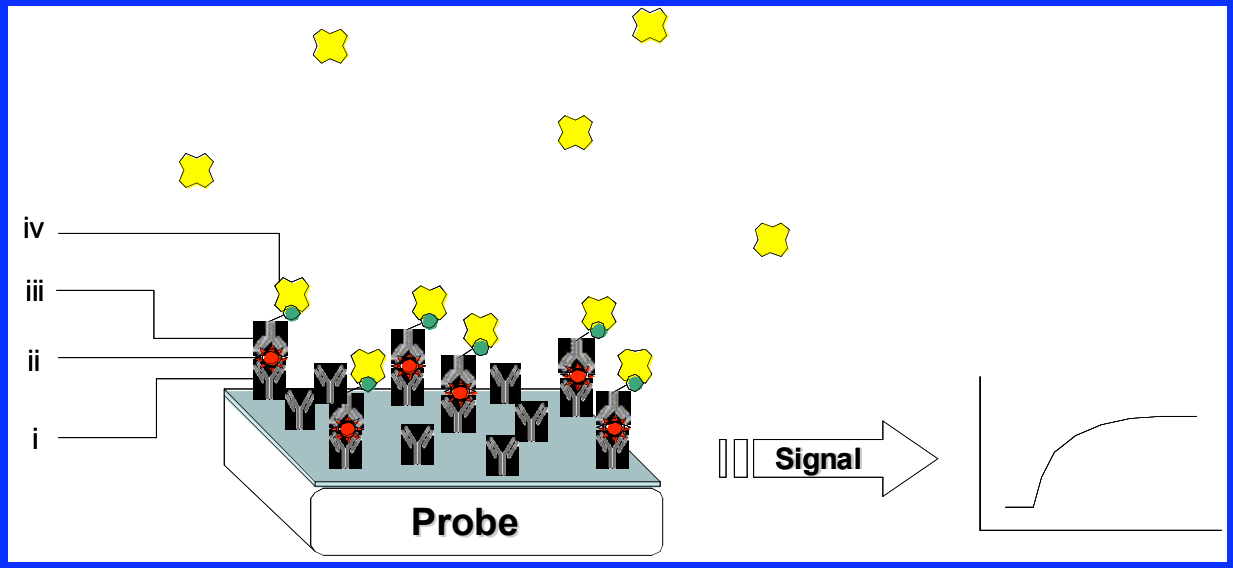


Figure 1.Schematic illustration of the magnetic nanotag-based immunoassay for mycotoxins. i) Positive probes are immobilized with primary antibodies of interest. ii) Analytes are mixed into a single pool for incubation; and iii) finally biotinylated secondary antibodies are added. iv) The binding of streptavidin-coated MNTs with secondary antibodies and the detection of magnetic signal in real time.

OUTCOME

One paper submitted for publication

One paper under review

Sustainability

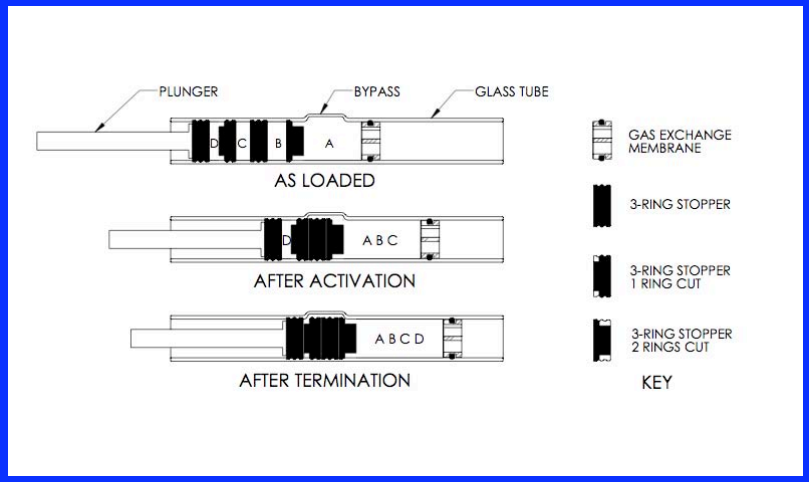
Intellectual Property Management and Technology Transfer

Facilitate Technical Scientific Exchange among Mis

Communicate with University Administrators and Communities

Expand Strategic Partnerships

URC MICROBIAL 1



Organisms
ATCC *E.coli* 4157
ATCC *B. subtilis* 1174
ATCC *B. subtilis* 6057

Media
Phosphate Buffered Saline, Water

GEGAP: Group Activation Pack

Proof of Concept
- **Optimum bacteria concn for Viability at 10 C**
- **Effects of Transfer from 10 C to 37 C or room temperature of kinetics of Growth- Lag phase**
- **RNA integrity following experiment termination by RNA protect, RNA liter or paraformaldehyde.**

CBER CENTER FOR BIO-NANOTECHNOLOGY AND ENVIRONMENTAL RESEARCH

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Thank You